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THE FOOD SUPPLY AND THE PRICE OF WHEAT.

IN 1879, in an address before the London Statistical Society, Mr. G. Shaw-Lefevre, said: "If I were to venture a prediction on so difficult and obscure a question, I would incline to the opinion that wheat has during the past year reached its lowest point."

This forecast was made a couple of years before the beginning of the great protracted decline in the prices of all agricultural produce that set in in the early years of the eighties. The forces which brought on the decline were already at work, and had been at work for some years before Mr. Shaw-Lefevre made his prediction; but the causes which seem very obvious after the fact may be quite obscure before it, and the causes that make for a permanent decline in agricultural produce are commonly more uncertain of prevision than those that make for a permanent rise. The former are apt to be of the nature of innovations, whose scope and efficacy can not well be foretold, while the latter are as apt to be simply the cumulative action of factors with whose scope and method we are already familiar.

Recognising, then, the chance of an unforeseen decline, and recognising, also, that there is more than one known factor already at work to bring about a decline in agricultural products in the near future, the purpose of this paper is to attempt an estimate of the possible maximum advance in the price of wheat (as a representative product of agriculture), supposing the factors that make for a decline to remain in abeyance for the next ten years.

The great permanent fall in prices that took place during the first half of the last decade has served as an object lesson to enforce the truth that there is a close dependence of price on supply. The fact of this dependence has been made much of both by those who hope for an advance in prices of farm produce, and by

those who deprecate the approach of a scarcity of bread. The assumption has been freely made that the date at which the land available for tillage shall have been definitively occupied is near at hand, and that when that day arrives a great and "sudden" advance in agricultural prices is to be looked for, with its consequences, of great gains for the farmer—for the American farmer perhaps, in an especial degree—and of distress for all peoples who get their supply of food largely from other countries. This sweeping generalisation merits some scrutiny.

It is unquestionably true that the price of wheat depends on the supply, but it is no less true that, other things being the same, the annual average supply of wheat depends, in the long run, on its price. The control exercised by the supply over the price is direct and transient. That exercised by the price over the annual average supply is of slower action, but it is also more permanent. We have therefore not said the last word in saying that when the demand shall have outgrown the present annual supply, the price of wheat will advance. The converse is also true; when the price of wheat begins to advance appreciably beyond what will barely remunerate the growers of wheat to-day, the supply will presently increase. The date of the definitive occupation of the tillable area yet available will no doubt mark an advance in the price of wheat, other things remaining unchanged; but the date of a definitive advance in price will no less surely mark an increase in the output from the acreage already under cultivation in the older wheat-growing sections. When this event comes to pass the farmers in the older sections will find it to their advantage to give their land such additional attention as will increase the yield per acre from the land already in cultivation, and so to some extent cover the shortage to which the rise in price is due and break the force of the advance. At the same time recourse will be had in an increasing degree to lands which are scarcely profitable for tillage at the prices which have been ruling for some years past.

The increased demand that is expected to advance the price of wheat will come as a result of an increase of the population

of bread-eating countries. An increased demand for wheat accordingly implies an increase of approximately the same proportions in the demand for other food products; therefore any considerable increase of the acreage sown to wheat will be practicable only as a feature in the general increase of the acreage of arable land. The increased supply of wheat, as of other food products, will therefore have to be obtained, in part, by an increased yield per acre from the acreage already in cultivation.

While we have by no means reached—or nearly reached—the limit of the possible extension of the wheat area in America, it is probably true that we are fast approaching the point beyond which there is no considerable additional amount of wheat lands equally fertile and otherwise equally available with the last ten or twenty million acres already brought under cultivation. It can hardly be said that the spread of cultivation in America during the past ten or twelve years has been to less fertile or less available lands; but for the next ten or twelve years, barring unforeseen developments, any considerable further spread of the area of cultivation can not take place without recourse to less available lands. The practical working of the law of diminishing returns will therefore assume an importance for our farming which it has not had for some time past. This practical working of the law will appear in the relation between the price and the yield per acre.

The yield per acre and the prices of farm produce vary considerably as between the different sections of the country, and, so far as concerns the older sections, they vary together, with some regularity; but the difference in prices between different localities is too slight, and the difference in other respects is too great to afford satisfactory figures from which to infer what is the effect, on the yield, of a given local advantage in price. The divergence in price is not pronounced nor easily ascertainable, as between states which are in other respects available for our comparison. Evidently no value can attach to a comparison of the newer, spring-wheat states with the older, winter-wheat states. But it may be remarked that Vermont, Massachusetts and Con-

necticut show a higher yield than any of the Ohio Valley states.

It will be more to the purpose, because the divergence both in price and in yield is great enough to afford tangible evidence of the efficacy of the forces at work, to compare the price and yield per acre in Great Britain with the price in Chicago and the yield per acre in the winter-wheat states lying about Chicago. The yield per acre of wheat in Great Britain is very considerably greater than in the states about Chicago. The immediate cause of its being so is the higher price obtained for wheat, and for other farm produce, by the British farmers; and the degree of effectiveness of the inducement offered them in the way of higher prices ought to help us to forecast the probable efficacy of an appeal of the same kind to the industry of their American competitors.

The winter-wheat states centering about Chicago and the great lakes—Ohio, Indiana, Illinois, Wisconsin and Michigan—may, in some respects, not unfairly be compared with Great Britain. They are like that country in being a country of mixed farming, and, as regards wheat production, mainly a winter-wheat country. Their farm lands have also been under cultivation for such a length of time as in large measure to obviate the complications which the “virgin soil” would introduce into any comparison of the newer states of the west with the countries of Europe. In some respects these states do not afford a close parallel to the farming lands of Great Britain. The climate is not the same, and the faults of the climate are not of the same kind. In the states mentioned there is more danger from drought than from wet seasons; in the United Kingdom it is all the other way. A bad season in England is sure to be a year of deficient heat, or excessive moisture, or both. Further, the soil of these states does not closely resemble the British soil in point of adaptation to wheat culture. These states do, however, afford as nearly fair a comparison with British soil and climate as any part of America that is a sufficiently representative wheat-growing region, and at every point where the comparison seems to be vitiated by in-

herent differences the difference is in favor of the states, as a superior country for wheat-growing and for mixed farming. The American soil is more fertile and more easily tilled; the climate of the states is better adapted for wheat-growing; the American farmers are probably not at all inferior to the British in intelligence or enterprise. So far as the inherent difference in natural advantages may lead us astray in drawing any inferences from a comparison of this group of states with Great Britain, the error would be in the direction of too low an estimate of the wheat-growing capacity of the states under the stimulus of a higher price. And as the object of the inquiry is to estimate the probable minimum effect on supply of a given permanent advance in price, rather than the maximum capacity of the states under such a stimulus, this is not a danger that need be specially guarded against.

An objection of greater weight may be found in the difference between British and American prices of staples, other than agricultural produce. The higher general level of prices of what the American farmer has to buy places him at a disadvantage, as compared with the British farmer, in precisely the same way as the lower price he gets for what he has to sell. The hindering effect of the higher price of staples must accordingly be allowed for in calculating the effect which a given rise in the price of farm products will have in the way of increasing the intensity of culture.

This higher range of prices does not comprise all articles of consumption used by the farmer. Lumber, and forest products generally, are lower here than in England. Farm implements of most kinds are rather cheaper; leather goods are scarcely higher; many of the staple food products are cheaper. But after all has been said, it is not to be questioned that the American farmer has to pay a somewhat higher average range of prices for what he buys (outside of agricultural products) than his British competitor. The American tariff, to the extent to which it is protective, increases the price of the articles on which it is laid, and among these articles are many important items of the farmer's necessary consumption.

It is difficult to say, even approximately, how much of a handicap this added cost is to American farming. It assuredly does not amount to more than 20 per cent. of the value of our farm products at Chicago prices; probably the actual additional cost to the farmers is considerably less than 20 per cent. of the value of their products.

Against this higher cost of necessities in America may be offset the lower margin of cultivation in Great Britain,—using the term in the sense of a resort to poorer soils. The natural fertility of the poorest soils in cultivation in Great Britain, in the system of mixed farming of which wheat culture is an integral part, is greatly lower than that of the poorest class of soils cultivated in the states named. This implies a correspondingly greater average cost of production of the products of British farming,¹ and it affects also the cost of many of the necessities of life to the British farmer.

The advantage is as definitely on the side of the states with respect to the margin of cultivation, as it is on the side of Great Britain with respect to the range of general prices. Here, again, it is impossible to say how great the advantage of the one over the other may be, but it is not unlikely that the disadvantage of the British farmer in this respect may completely offset the disadvantage which the American farmer has in the matter of higher general prices.

It may be thought that the fact that the agricultural depression in Great Britain during the whole of the period chosen for comparison (1884–92) has been severer than in America, would vitiate any British data for comparison with our own in any case where the point at issue turns on the question of a remunerative price. This difficulty is not a very serious one in any case, and does not affect the question in hand at all. What is required for the validity of the argument is: (1) that the inducements to

¹ This statement does not imply that rent is an element in the cost of production. What is claimed is that Great Britain, as a whole, because of its lower margin of cultivation, gets the products of its soil at a greater average expenditure than do the states, and that a given increment in the price will induce a less increment in yield at this lower margin than at the higher margin of cultivation existing in the states.

wheat culture in Great Britain, relatively to other tillage, should not be greater than in the states; and (2) that the least fertile lands cultivated in the British system of farming should not be intrinsically superior to the lands similarly at the margin of cultivation in the states. It needs no argument to establish that both these conditions are fully met and will continue to hold for an indefinite time to come.¹

If the considerations adduced are admitted to be valid, to the extent that wheat growing in a system of mixed farming in the states named lies under no other or greater disadvantage as compared with wheat growing in Great Britain than that indicated by the difference in the price of a given grade of wheat between Chicago and Liverpool, then we have the premises from which to deduce approximately what will be the maximum possible advance in price required to induce a given increase in the average yield per acre of wheat in the states. And this will afford some indication of what will be the maximum possible advance in price resulting from a given increase in the consumption of wheat.

The prices selected for comparison are average prices of American No. 2 Red Winter Wheat in Liverpool and in Chicago, since 1884.

While this grade of wheat is not grown in England, the quotations for this grade are quite as significant for wheat prices in England as any quotations obtainable. The Gazette averages, which are usually quoted, are for British wheat, without respect to quality; and the average quality of the grain from which the quotations are made up will accordingly vary from year to year, with the character of the harvest. Gazette averages are useless for any exact comparison.

¹ The depression in British farming, so far as it is not due to bad harvests, is due to the decline in prices; and this decline has affected grain production rather more strongly than other tillage. Its most pronounced economic result has been a readjustment of rents on a lowered basis. Apart from adverse seasons, the British farmers' chief real grievance is too high rents. Prices have fallen some 30 per cent. or more; money rents, except in isolated cases, have not been lowered to correspond. In addition to this, the farmers have suffered from a depreciation of the capital they have had invested in farming; which is also a considerable item.

The reason for not making up the averages for a comparison of prices from a series of years reaching back of 1884 is obvious. Wheat culture had not, until that time, adjusted itself to the changed conditions of the market that supervened about 1880-82. The years immediately preceding 1884-85 were years of great changes in the price and acreage of wheat. By 1884 the decline was completed, and the price of wheat has moved on a lower level since that time than before. About the same time the decline in acreage in the states selected had also practically ceased; though a slight tendency to a further narrowing of the acreage has been perceptible since that time, at least until 1890.

The average yield per acre of wheat for the eight years since 1885² in the states selected has been about 13¾ bushels.³ This average includes the extraordinary harvest of 1891 (17½ bushels per acre). But even counting 1891, this average is probably slightly short of the normal average yield for these states, the seasons during the latter half of the eighties having been, on the

¹ The extraordinary decline in wheat acreage in the Ohio valley group of states in 1885 was due quite as much to an unfavorable season as to a voluntary narrowing of the area. The acreage regained in 1886 more than half of what had been lost in 1885. The definitive effect on acreage of the decline in price that ended in 1884, was not had until the following year. In studying the movement of acreage under the influence of the new level of prices then established, the new period is to be considered as having begun with 1885.

² The average yield for the years 1885-92 has been taken, as, for the present purpose, answering to the price during the years 1884-91. The yield for the year 1884 was the same as the average for 1885-92.

³ The average annual yield has been:

Year	In the States; bushels (Winchester)	In Great Bri- tain; bushels (Imperial)
1885	11.19	31.31
1886	14.41	26.89
1887	13.38	32.07
1888	12.02	28.05
1889	14.91	29.89
1890	11.74	30.74
1891	17.49	31.26
1892	14.40	26.38
Average.	13.78	29.57

whole, rather unfavorable for winter wheat. The average yield of the same states for the years 1877-83, when the seasons were, on the whole, very favorable, was $14\frac{3}{4}$ bushels. The lower average yield during later years seems to be due, in a slight degree, to a partial displacement of wheat by other crops on some of the more fertile and better-tilled soils; or perhaps more exactly, to a relative neglect of wheat-growing by some of the more capable and better equipped farmers; but the great cause of this discrepancy lies, no doubt, in the character of the seasons. When due weight is allowed to all these factors, we shall be very near the truth in assuming 14 bushels per acre to be the present normal average yield of wheat in these states.

For Great Britain the officially assumed normal average yield of wheat is 28.80 bushels per acre. The actual annual average for the eight years since 1885 is 29.57 bushels.¹ It is difficult to say whether the officially assumed normal average is nearer the true normal than the recorded actual average. The *London Economist*, as well as some other authorities, claims the true normal average to exceed 29 bushels. The seasons during the eighties have been, on the whole, rather more favorable for wheat than the average of a long series of years. If this were the sole modifying circumstance the official normal average would have to be accepted as very near the true normal. But this circumstance does not account for the whole of the discrepancy between the average yield of today and that of some years ago. It has been pointed out that the average has also probably been raised by the dropping of some of the inferior soils out of wheat cultivation. At the same time, improvements in agriculture seem also to have affected the average yield in the same direction. It will be safe to take 29 bushels per acre as the actual normal average yield of wheat in Great Britain.

The average yield in Great Britain exceeds the yield in the states by about 107 per cent. (15 bushels). The annual average price of American No. 2 Red Winter Wheat in Liverpool, for the years 1884-91, exceeds the average price of the same grade in

¹ See note 3, page 372.

Chicago by a trifle over 20 per cent. (18.095 cents per Winchester bushel).¹ It ought to be a safe inference that a gradual advance in the price of wheat in the Chicago market to the present level of the price in Liverpool (accompanied, as in the normal course of things it would be, by a corresponding advance in the prices of other farm produce) would result in such an advance in the intensity of culture in the states lying about Chicago as to increase the average yield of wheat, during the early stages of the advance, in the same proportion as the British yield is higher on account of the higher British price. That is to say, a sufficiently gradual and permanent moderate advance, of a given per cent., in price, in the Chicago market, should result in an increase in the yield per acre of wheat in these states, of at least five times as many per cent. Twenty per cent. (18 cents per bushel) advantage in price in Liverpool carries with it 107 per cent. (15 bushels) advantage in the yield per acre in Great Britain. A gradual advance of 5 per cent. (4.36 cents per bushel) in the annual average price in Chicago ought to bring an increase of more than 20 per cent. (2.8 bushels) in the yield per acre of wheat in the states lying about Chicago, supposing the conditions of production otherwise to remain unchanged.

The aggregate annual production of the five states named, for the eight years 1885-92, has averaged slightly over 140 million bushels. If the price of wheat in Chicago were to advance permanently to 95.84 cents per bushel (10 per cent) we should have to expect the total annual production of these states to rise to not much less than 210 million bushels (50 per cent.).

¹ Annual average price of No. 2 Red Winter Wheat, in cents per bushel:

Year	Chicago	Liverpool
1884	89.3	107.2
1885	88.3	103.1
1886	77.6	99.6
1887	77.2	98.7
1888	92.5	107.4
1889	85.2	102.8
1890	89.5	105.3
1891	97.3	117.7
Average.	87.13	105.225

Assuming that the advance in price would have an equivalent effect on the output in the other wheat regions (and the chances would seem to be that the effect would be relatively at least as great in the remoter wheat fields, since the per cent. advance in price in the remoter local markets would be appreciably greater, and any inability to increase the yield on the newer wheat lands would be fully offset by an extension of the area), and considering also that such an advance in price would induce some increase in acreage in all the wheat producing country, an ordinary average price of 96 cents in the Chicago markets might be expected to bring out an aggregate annual product of not less than 800 million bushels.

Conversely, No. 2 Red Winter Wheat cannot advance permanently to 96 cents in Chicago until there is a customary demand for about 800 million bushels of American wheat at the increased price. A ten per cent. advance in price presumes something near a fifty per cent. increase in the demand.

The increase in the demand for wheat will coincide approximately with the increase of the bread-eating population. Judging of the future by the past, it will be a liberal estimate to say that the bread-eating population of the countries which draw on the supplies of the general market to which America contributes, may be expected to increase by ten per cent. in ten years. It has perhaps reached that rate of growth during the last decade, and it would be extravagant to expect that rate to be exceeded during the next decade.

The price which it would be necessary to offer for wheat in order to meet this increased demand by an increased production is more a matter of surmise than the probable rate of growth of population. If we could answer this question, we should know approximately what prices our farmers may look for in payment for their produce during the opening years of the twentieth century. There is reason to believe that, barring unforeseen innovations, at the point in the growth of the demand for food at which there will be an effective demand for one-and-one-half times as much American wheat as at present, the price will have to be

advanced by not more than nine cents above the present ordinary average price in Chicago. In the meantime, a less increase in the demand could be met at a less advance in price. An increase of ten per cent. (200,000,000 bushels) in the world's consumption of wheat would mean, if the demand were distributed as it is at present, an increase of about 50 million bushels in the portion ordinarily required of America. This additional demand could be met, without increase of acreage, by an addition of about $1\frac{1}{4}$ bushels to the present average yield per acre of wheat; and this additional $1\frac{1}{4}$ bushels would be forthcoming without its being necessary to advance the price in the local markets by as much as two cents per bushel above the average of the last eight or nine years.

But the additional demand will not fall *pro rata* on the countries which now supply the world with wheat; and the like is true to almost the same extent of the supply of other agricultural products. America now, of late years, supplies rather less than one-fourth of the total wheat product. She will certainly be called on to contribute more than one-fourth of the additional 200 bushels that will be required before the end of another ten years, unless some unforeseen contingency should come in to change the complexion of things.

An advance in price would have some effect on the intensity of culture in all agricultural countries, but the effect would probably be very slight in such regions as the wheat lands of Russia and India, especially the latter. In these countries, as well as in large portions of Western Europe, notably in France, agriculture is in the hands of a population that does not respond readily to promptings from without. Whatever addition may be made to the wheat supply furnished by those countries—apart from additions due to improved facilities for transportation—will be made slowly, and will at best be inconsiderable for some time to come. The new demand will fall first and most heavily on the American, Australian and South American wheat lands, and on such portions of Europe as Great Britain, Austria, parts of Germany, &c., together with some contributions due to an increase of acreage in Russia.

This fact, that the intensity of culture of a considerable portion of the present wheat-producing area of the world will be but partially and feebly affected by a moderate advance in the price, will necessitate a higher production on the part of that portion which will more readily respond to the call. It results in a virtual narrowing of the area from which the additional supply can be obtained, so as to include little else than the newer wheat-growing countries, with portions of Western Europe. These regions will therefore be called on to furnish more than their *pro rata* contingent to the increase, and this greater rate of production in these countries will be obtained only at the cost of a greater advance in price.

Of these more manageable countries, not all would respond to the demand with equal alacrity. It is, for example, easier for America to add one-tenth to her average yield of $12\frac{1}{4}$ bushels than it is for England to add one-tenth to her yield of 29 bushels.¹

This fact goes in the same direction and adds further to the necessity of a higher price in the American market than would have been required if America were called on to furnish her *pro rata* increase only.

America has of late contributed something less than one-quarter of the world's annual wheat supply. If the facts above recited are allowed the extreme weight implied in looking to this country for one-half instead of one-fourth of the additional 200 million bushels that will be required by the end of another ten years, then it will be necessary to increase the yield of wheat in America, not by one-tenth, as was assumed above, but by one-fifth; that is, from $12\frac{1}{3}$ bushels to 14.8 bushels per acre for the whole country, or from 14 bushels to 16.8 bushels per acre for the five states named. To maintain such an increase in the American yield of wheat would require an advance

¹It must not be supposed that England, or any part of Europe, is near the limit of productivity. The *London Economist* of September 13, 1890, says: "High authorities have estimated that we might double the produce of the soil in the United Kingdom even under our existing system of farming. As it is, there are farmers who grow nearly double the average of grain crops for the kingdom as a whole, and many who produce twice the average weight of roots and potatoes."

of less than $4\frac{1}{2}$ per cent. (3.8 cents per bushel) in the price of wheat in Chicago.

But as some increase in acreage is sure to result from any advance in price, allowance must be made for the increased supply to be obtained by this means. How great the effect on the acreage will be, it is impossible to say. On the other hand, it is pretty certainly true that any advance in price will not have as great an effect in increasing the yield in the newer states, especially in the spring-wheat country, as in the group of states with which we set out. The chief increase in product in the newer states will, for some time to come, be got by increasing the acreage. It may be accepted without much risk that this increase in acreage will fully make up for the slighter increase in the yield per acre, so that the conclusion already arrived at need not be modified on that account.

If, therefore, these premises are accepted as sound and adequate, there is small chance that the normal increase in the demand for bread will permanently raise the average price of No. 2 wheat above 91 cents in the Chicago market within the next ten years.

This estimate proceeds on the supposition that no considerable advance is taking place or will take place the next few years in the methods of farming or in any of the industries that have to do directly or indirectly with the food supply. This of course is an extreme position. If, as is quite probable, improved industrial knowledge and processes should appreciably lessen the cost of production of grain in the newer wheat countries, this estimate would probably prove too high. And if, as is still more probable, the prices of staple articles of consumption in America should decline, relatively to those of farm produce, the chance of any advance in wheat or in farm products generally, would be still further narrowed. If, for example, American import duties on staples should be lowered within the next ten years sufficiently to diminish the cost of the farmer's necessary articles of consumption by 20 per cent. (and such a result is possible), the chance of any permanent advance in wheat for the present would disappear.

Even apart from any lowering of the cost of articles of necessary consumption, it is fully within the possibilities of the situation that no permanent advance in farm products need take place at all for a generation or more. Better methods and a more intimate knowledge of the natural processes concerned in farming are probably capable, as competent authorities insist, of so adding to the efficiency of our farming as not to admit of prices going higher than they are.

Agriculture is fast assuming the character of an "industry," in the modern sense, and the development of the next few decades may not improbably show us, in farming as in other occupations, a continual improvement in methods and a steady decline in cost of production, even in the face of a considerably increased demand.

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